186′ enables the appropriate columns of diode matrix 13′, while gated column drivers 284 in response to the strobe pulses over line 283, cause the appropriate diode columns to be energized at time associated with the particular over-temperature event being recorded or retrieved from storage 62′.

In this manner the circuitry of FIG. 3 functions to continuously cycle digital storage 62′, and selectively position the temperature data from converter 31′ at unique time slots within the shift register as a function of the time-based counter and event multiplexer. At the end of an aircraft flight or series of flights, data from digital storage 62′ may be retrieved in the following manner.

For manual retrieval, a manual incrementing switch 286 is provided for manually stepping event counter 252 to cause successive positioning of event multiplexer 256 and selective interrogation of digital storage 62′. This causes time-based counter circuit 85′ to be properly phased for retrieving the temperature data associated with each of the available events within counter 252. If desired, this data for each event may be passed directly to external recording equipment through the aforementioned temperature data buffer 261, time data buffer 262 and event data buffer 258.

Alternatively, an external incrementing control may be used by applying an external incrementing signal to input 287 of counter 252 for automatically stepping the counter through each of the previously recorded over-temperature events.

If the number of over-temperature events exceeds N, in other words exceeding the memory capability of the circuit, event counter 252 overflows on an output line 288 which is connected to and for disabling time-based synchronization circuit 263, preventing circuit 263 from further responding to a further over-temperature event as sensed by threshold comparator 251.

Accordingly in summary, the circuit of FIG. 3 functions to sense, digitally record and display each of a succession of over-temperature events in the following manner. Assuming that the circuitry is all reset and clock generator 71′ is running, an over-temperature at input 32′ trips threshold comparator 251 and sets event counter 252 to its first counting state. This in turn causes event multiplexer 256 to select decode line No. 1 from decoder 273 and concurrently time-based synchronization circuit 263 enables time-based counter circuit 85′ as soon as column counter 186′ overflows at output 291. This synchronizes the time-based counter circuit with the column sweep. After $8Nn + 1$ clock pulses later, time-based counter circuit 85′ at output 277 triggers one-shot multivibrator 103′ and the temperature data available at converter 31′ at that time is entered into digital storage 62′.

This data is recirculated in the shift register in synchronism with the event time slot counter 272 and the column counter 186′. Thus temperature data will be present at the shift register output 292 at the same time that column counter 186′ selects matrix column 1 and event time slot counter 272 advances the stage of column counter 186′ and event multiplexer 256 strobes gated column drivers 284 over line 283. The first column of LED matrix 13′ and of the temperature histogram will thus be diplayed.

Because of the clock pulse phasing operation of the time-based counter circuit 85′, the shift register of digital storage 62′ will permit entry of the next temperature word in synchronism with the enabling of column 2 by column counter 186′. In this manner the temperature data levels are stored and displayed until the sweep termination counter 278 overflows and disables the time-based counter circuit.

Should a second over-temperature occur, this will be detected by comparator 251, advancing event counter 252 to the second state. Up to N events can thus be recorded, after which, event counter 252 overflows at output 258 inhibiting the time-based synchronization circuit 263 from further enabling the time-based counter circuit.

This operation organizes the temperature data in the shift registers of storage 62′ in the form of N byte words for each matrix display column. Each byte contains the temperature data for one of the N events recorded.

As in the case of the previous embodiment, a power source monitoring circuit 201′ may be provided for detecting a loss of the normal power source and enabling a memory battery 213′ to continue to supply voltage to and for maintaining the memory function of the various digital logic and storage circuits.

While only a limited number of embodiments of the present invention have been disclosed herein, it will be readily apparent to persons skilled in the art that numerous changes and modifications may be made thereto without departing from the spirit of the invention. For example, the embodiments of FIG. 2 and 3 of the present invention may be modified to provide for recording of data from over-temperature events occurring in more than one aircraft engine. In such case, the over-temperature levels from the plurality of engines may be multiplexed and stored in a manner similar to the storage of temperature data from a single engine, as described more fully above. Also, the instrument circuitry may be modified to include additional logic functions for a stall condition, hot start, hung start and other special engine conditions.

Accordingly, the foregoing disclosure and description thereof are for illustrative purposes only and do not in any way limit the invention which is defined only by the following claims.

What is claimed is:

1. Apparatus for receiving an electrical signal representing a temperature condition of a jet engine and sensing, storing, and displaying an over-temperature event incurred by such engine, comprising:

an analog to digital converter means adapted to receive said electrical temperature signal and convert it to a digital temperature signal;

over-temperature sensing means responsive to said temperature signal and having an electrical output indicating that said engine has commenced an over-temperature event;

digital storage means;

electrically energized, light emitting, solid state matrix display means; and

time base generator means connected and responsive to said electrical output of said over-temperature sensing means and connected to and for conditioning said storage means to store said temperature signal at each of a plurality of time intervals in response to said over-temperature sensing means indicating the commencement of said over-temperature event, and said display means connected to said storage means and to said time base generator means for graphically displaying said stored temperature signals as a function of time.